Techior Solutions Pvt. Ltd.

CBSE XII Physics Sample Paper

Total Time: 3 Hr | Total Marks: 70.0

Physics

Section A

MCQ Single Correct

1) The electric field inside a conductor in electrostatic equilibrium is: **1.0**

- **A)** Zero
- **B)** Maximum
- **C)** Minimum
- **D)** Constant

2) In which direction does the magnetic force act on a moving charged particle in a magnetic field? **1.0**

- **A)** Parallel to the particle's velocity
- **B)** Perpendicular to both the velocity and the magnetic field
- **C)** Opposite to the direction of the magnetic field
- **D)** Opposite to the direction of the particle's velocity

3) Gauss's Law can be used to find the electric field at points: **1.0**

- **A)** Inside a uniformly charged conducting shell
- **B)** Outside a uniformly charged conducting shell
- **C)** At the surface of a uniformly charged conducting shell
- **D)** All of the above

4) A current is flowing north along a power line. The direction of the magnetic field above it neglecting the earth's field is towards. **1.0**

- **A)** north
- **B)** east
- **C)** south
- **D)** west
- **E)** none of these

5) Assertion : Cyclotron does not accelerate electron. **1.0**
Reason : Mass of the electrons is very small.

- **A)** If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion
- **B)** If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion
- **C)** If the Assertion is correct but Reason is incorrect
- **D)** If both the Assertion and Reason are incorrect

6) The thermal neutrons in a nuclear reactor may be regarded as a gas at a temperature T°K which obeys the laws of kinetic theory. Then the de-Broglie wavelength of such thermal neutrons in terms of temperature T_1 mass of neutron m is given by: **1.0**

A) $\lambda = \frac{h}{\sqrt{3mKT}}$

B) $\lambda = \frac{\lambda}{\sqrt{6mKT}}$

C) $\lambda = \frac{\lambda}{\sqrt{5mKT}}$

D) $\lambda = \frac{\lambda}{\sqrt{2mKT}}$

7) Which equation best represents the relationship between the kinetic energy of emitted electrons (K), the energy of incident photons (E), and the work function (Φ)? **1.0**

A) $K=E-\Phi$

B) $K=\frac{E}{\phi}$

C) $K=E+\Phi$

D) $K=\frac{E}{2\phi}$

8) Assertion : According to classical theory the proposed path of an electron in Rutherford atom model will be parabolic. **1.0**
Reason : According to electromagnetic theory an accelerated particle continuously emits radiation.

A) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion

B) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion

C) If the Assertion is correct but Reason is incorrect

D) If both the Assertion and Reason are incorrect

9) What is the main disadvantage of nuclear fusion compared to nuclear fission? **1.0**

A) Higher risk of accidents

B) Production of radioactive waste

C) Requirement of extremely high temperatures and pressure

D) Limited fuel availability

10) What is the maximum number of electrons that can occupy the 3rd energy level in an atom? **1.0**

A) 2

B) 8

C) 18

D) 32

11) The speed of electromagnetic waves in a medium of dielectric constant 2.25 and relative permeability 4 is: **1.0**

A) $1.10^8\ m/s$

B) $25\times10^8\ m/s$

C) $2\times10^8\ m/s$

D) $3\times10^8\ m/s$

12) The ratio of longest wavelength and the shortest wavelength observed in the five spectral series of emission spectrum of hydrogen is: **1.0**

A) 4/3

B) 525 / 376

C) 25

D) 900/ 11

13) Which of the following particles has similar mass to that of the protons? **1.0**

A) Proton

B) Neutron

C) Positron

D) Neutrino

14) What happens to the resistance of a conductor as its temperature increases? **1.0**

A) Increases

B) Decreases

C) Remains constant

D) Fluctuates randomly

15) Which of the following materials typically exhibits a negative temperature coefficient of resistance? **1.0**

A) Metals

B) Insulators

C) Semiconductors

D) Superconductors

16) The phenomena involved in the reflection of radiowaves by ionosphere is similar to **1.0**

A) reflection of light by a plane mirror.

B) total internal reflection of light in air during a mirage.

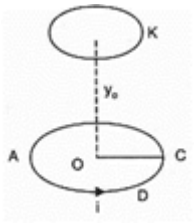
C) dispersion of light by water molecules during the formation of a rainbow.

D) scattering of light by the particles of air.

Section B

Short Description

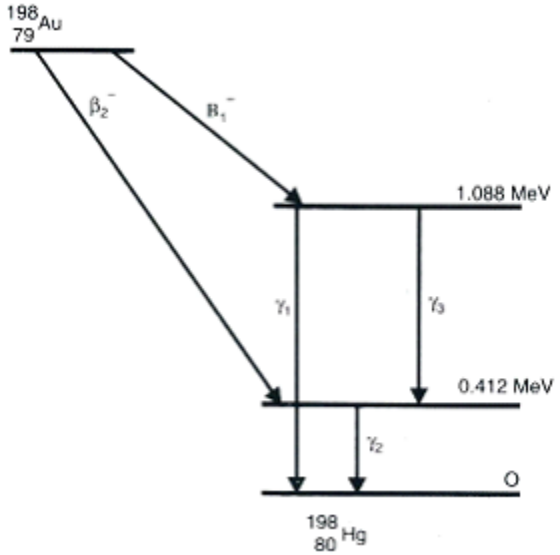
17) A coil ACD of N turns and radius R carries a current I ampere and is placed on a horizontal table. K is a small conducting ring of radius r placed at a distance y_0 from the centre of and vertically above the coil ACD. Find an expression for the emf established when the ring k is allowed to fall freely. Express the emf in terms of speed. **2.0**



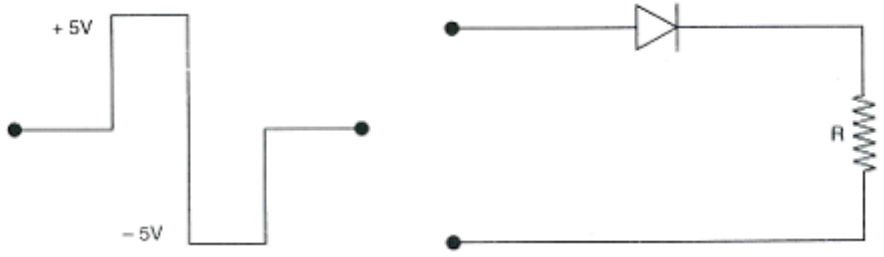
18) Obtain the maximum kinetic energy of $\beta-$ particles, and the radiation frequencies of γ decays in the decay scheme shown in figure. You are given that **2.0**

$m(^{198}Au) = 197.968233$ u

$m(^{198}Hg) = 197.966760$ u



19) Draw and explain the output waveform across the load resistor R, if the input waveform is an shown in the given figure. **2.0**



20) How is the mutual inductance of a pair of coils affected when: **2.0**

(i) separation between the coils is increased?

(ii) the number of turns of each coil is increased?

(iii) A thin iron sheet is placed between the two coils, other factors remaining the same?

21) Two metals A and B have work function 2 eV and 5 eV respectively. Which metal has lower threshold wavelength? **2.0**

---OR---

The maximum kinetic energy of a photoelectron is 3 eV. What is its stopping potential?

Section C

Medium Description

22) The optical properties of a medium are governed by the relative permitivity (ε_r) and relative permeability (μ_r). The refractive index is defined as $\sqrt{\mu_r\varepsilon_r} = n$. For ordinary material $\varepsilon_r > 0$ and $\mu_r > 0$ and the positive sign is taken for the square root. In 1964, a Russian scientist V. Veselago postulated the existence of material with $\varepsilon_r < 0$ and $\mu_r < 0$. Since then such 'metamaterials' have been produced in the laboratories and their optical properties studied. **3.0**

For such materials $n = -\sqrt{\mu_r\varepsilon_r}$. As light enters a medium of such refractive index the phases travel away from the direction of propagation.

(i) According to the description above show that if rays of light enter such a medium from air (refractive index =1) at an angle θ in 2nd quadrant, them the refracted beam is in the 3rd quadrant.

(ii) Prove that Snell's law holds for such a medium.

23) An electron traveling west to east enters a chamber having a uniform electrostatic field in north to south direction. Specify the direction in which a uniform magnetic field should be set up to prevent the electron from deflecting from its straight line path. **3.0**

24) Consider a uniform electric field $E = 3 \times 10^3 \hat{i}\ N/C$. (a) What is the flux of this field through a square of 10 cm on a side whose plane is parallel to the yz plane? (b) What is the flux through the same square if the normal to its plane makes a 60° angle with the x-axis? **3.0**

25) A long solenoid 'S' has 'n' turns per meter, with diameter 'a'. At the centre of this coil we place a smaller coil of 'N' turns and diameter 'b' (where b < a). If the current in the solenoid increases linearly, with time, what is the induced emf appearing in the smaller coil. Plot graph showing nature of variation in emf, if current varies as a function of $mt^2 + C$. **3.0**

26) A convex lens of focal length 20 cm and a concave mirror of focal length 10 cm, are placed co-axially 50 cm apart from each other. An incident beam parallel to its principal axis, is incident on the convex lens. Locate the position of the final image formed due to this combination. **3.0**

27) (a) An electrostatic field line is a continuous curve. That is a field line cannot have sudden breaks. Why not? **3.0**

(b) Explain why two field lines never cross each other at any point?

28) An applied voltage signal consists of a superposition of a dc voltage and an a.c. voltage of high frequency. The circuit consists of an inductor and a capacitor in series. Show that the dc signal will appear across C and the ac signal across L. **3.0**

---OR---

(a) The peak voltage of an ac supply is 300 V. What is the rms voltage?
(b) The rms value of current in an ac circuit is 10 A. What is the peak current?

Section D

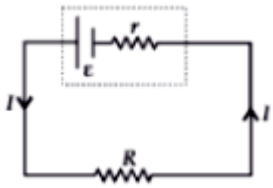
Case Study

Solve Question 29 to Question 32 based on the following paragraph:

Case Study 7:

Read the following passage and answer the questions:

Emf of a cell is the maximum potential difference between two electrodes of the cell when no current is drawn from the cell. Internal resistance is the resistance offered by the electrolyte of a cell when the electric current flows through it. The internal resistance of a cell depends upon the following factors;
(i) distance between the electrodes
(ii) nature and temperature of the electrolyte
(iii) nature of electrodes
(iv) area of electrodes.



For a freshly prepared cell, the value of internal resistance is generally low and goes on increasing as the cell is put to more and more use. The potential difference between the two electrodes of a cell in a closed circuit is called terminal potential difference and its value is always less than the emf of the cell in a closed circuit. It can be written as V = E - Jr.

29) The terminal potential difference of two electrodes of a cell is equal to emf of the cell when **1.0**

A) I≠0
B) I=0
C) both (a) and (b)
D) neither (a) nor (b)

30) A cell of emf ε and internal resistance r gives a current of 0.5 A with an external resistance of 12 Ω and a current of 0.25 A with an external resistance of 25 Ω .What is the value of internal resistance of the cell? **1.0**

A) 5Ω
B) 1Ω
C) 7Ω
D) 3Ω

31) An external resistance R is connected to a cell of internal resistance r, the maximum current flows in the external resistance, when **1.0**

A) R = r

B) R < r

C) R> r

D) R=l/r

32) Choose the wrong statement. **1.0**

A) Potential difference across the terminals of a cell in a closed circuit is always less than its emf

B) Internal resistance of a cell decrease with the decrease in temperature of the electrolyte

C) Potential difference versus current graph for a cell is a straight line with a -ve slope

D) Terminal potential difference of the cell when it is being charged is given as $V = \varepsilon + Ir$

---OR---

A cell of emf ε and internal resistance r gives a current of 0.5 A with an external resistance of 12 Ω and a current of 0.25 A with an external resistance of 25 Ω .What is the value of internal resistance of the cell?

A) 5Ω

B) 1Ω

C) 7Ω

D) 3Ω

Solve Question 33 to Question 36 based on the following paragraph:

Case Study 2:

Read the following passage and answer the questions:

A transformer is essentially an a.c . device. It cannot work on d.c. It changes alternating voltages or currents. It does not affect the frequency of a.c. It is based on the phenomenon of mutual induction. A transformer essentially consists of two coils of insulated copper wire having different number of turns and wound on the same soft iron core.
The number of turns in the primary and secondary coils of an ideal transformer are 2000 and 50 respectively. The primary coil is connected to a main supply of 120 V and secondary coil is connected to a bulb of resistance 0.6Ω

33) The value of voltage across the secondary coil is **1.0**

A) 5 V

B) 2 V

C) 3 V

D) 10 V

34) The value of current in the bulb is **1.0**

A) 7 A

B) 15 A

C) 3A

D) 5A

35) The value of current in primary coil is **1.0**

A) 0.125 A

B) 2.52 A

C) 1.51 A

D) 3.52 A

36) Power in primary coil is **1.0**

A) 20W

B) 5W

C) 10W

D) 15W

---OR---

Power in secondary coil is

A) 15W

B) 20W

C) 7W

D) 8W

Section E

Long Description

37) If δ_1 and δ_2 be the angles of dip observed in two planes at right angles to each other and δ is the true angle of dip, then prove that **5.0**

$$\cot^2 \delta_1 + \cot^2 \delta_2 = \cot^2 \delta$$

---OR---

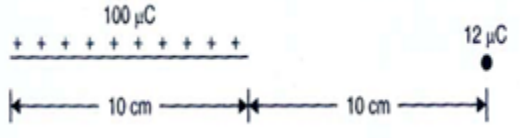
A solenoid of 500 turns per metre is carrying a current of 3A. Its core is made of iron, which has a relative permeability of 5000. Determine the magnitudes of magnetic intensity, magnetization and magnetic field inside the core.

38) (i) With the help of suitable my diagram, derive the mirror formula for a concave mirror? **5.0**
(ii) The near point of a hypemetropic person is 50 cm from the eye. What is the power of the lens required to enable the person to read clearly a book held at 25 cm from the eye?

---OR---

A parallel beam of light traveling in water (refractive index = 4/3) is refracted by a spherical air bubble of radius 2 mm situated in water. Assuming the light rays to be paraxial, (a) find the position of the image due to refraction at the first surface and the position of the final image and (b) draw a ray diagram showing the positions of both the images.

39) A $12\mu C$ charge is placed at the distance of 10 cm from a linear charge of $100\mu C$ uniformly distributed once the length of 10 cm as shown in figure. Find the force on $12\mu C$ charge. **5.0**



---OR---

Two fixed point charges +4e and +e units are separated by a distance a. Where should the third point charge be placed for it to be in equilibrium?